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UNITED STATES GOVERNMENT - Forest Service
Washington, 25, D. C.

Memorandum

2240

TO : R. M. DeNio, Director, Division of Range Management

DATE: May 1, 1961

FROM : F. C. Curtiss, Chairman, Range Seeding Equipment Committee

SUBJECT: Range Improvements

U.S. DEPT. OF AGRICULTURE
SEP 25 1962
C & R-PREP.

There follows a report of the fifteenth annual meeting of the Range Seeding Equipment Committee held at the Newhouse Hotel, Salt Lake City, Utah, on January 29 and 30, 1961. A copy of each written report submitted is attached to the original of this report.

The report of the proceedings of the meeting are arranged in the following order:

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Attachment

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REPORT OF THE FIFTEENTH ANNUAL MEETING OF THE
RANGE SEEDING EQUIPMENT COMMITTEE

Salt Lake City, Utah
January 29-30, 1961

The fifteenth annual meeting of the Range Seeding Equipment Committee was called to order by General Chairman Frank C. Curtiss at 9:00 A.M. January 29, 1961, at the Newhouse Hotel, Salt Lake City. The registered attendance totalled 150 persons representing Federal and State agencies, colleges and others interested in equipment development, from all parts of the United States.

For the benefit of those attending the meeting for the first time, Mr. Joe Wagner made a short statement concerning the history, activities, objectives and accomplishments of the Committee during its 15 years of existence.

It was recommended by Mr. Wagner that more name cards be planned for next year. The 135 prepared this year was not enough.

Robert D. Nielson of the Bureau of Land Management, Washington, D. C., was discussion chairman for the morning session.

Operating Hints Handbook Revision and Service Manual with Parts List

Subcommittee Chairman - A. C. Hull, Jr., ARS

1. A. C. Hull reported the Operating Hints booklet is now in final rough draft stage and will receive one more review by the Committee prior to submission for printing. A vote by the assembly unanimously approved publication as "pocket size" booklet which makes it readily adaptable as a ready reference for general field or project use to provide the basic operational hints for equipment.

Editing clearance will be needed by each agency before the printing job will be accepted by the U. S. Printing Office. Bert Reid suggested the preparation and arrangements for printing be turned over to someone who is trained to do this type of work. Joe Wagner is to follow up on this proposal. Joe Wagner reported it will cost about \$.45 each to print 1,000 copies. Copies of the printed "operational hints" will be provided on a basis of agency request, and then an additional 2,000 copies will be available with the Superintendent of Documents for distribution upon request. The publication will carry the authorship as follows: Published by RSEC (Range Seeding Equipment Committee).

2. Service Manuals - Considerable discussion was held relative to proposed publications as handbooks or manuals. Some thought these synonymous terminologies would be confused with administrative publications used in resource management and administration. Orval Winkler and Bob Nielson suggested referring to them as "Handbooks" - Murt Hiatt suggested using both "Manual" and "Handbook". The assembly approved a suggestion by Grant G. Williams to refer to the publication as "Equipment Service Manual and Parts List."

Thomas Coldwell, of Arcadia Equipment Development Center, reported the Equipment Service Manual and Parts List for the Brushland Plow (presented as Operation and Maintenance Handbook for the Brushland Plow) is now in the final draft for publication. He reported only minor changes since the draft was presented at last year's meeting. It is important to note the "Equipment Service Manual and Parts List" publications are for specialized use by mechanics, whereas the "Operating Hints" publication is intended to provide operating hints for general equipment operational use.

The publication is ready for printing and will be submitted upon the final endorsement by the Committee. These publications will be prepared only for specialized equipment for which there are no commercial manuals available.

The assembly approved the Committee's recommendation to publish the Equipment Service Manual and Parts List for the Brushland Plow as presented in the 9 x 11½" size. Printing for distribution should be completed in fiscal year 1962.

The Committee plans to follow up with an Equipment Service Manual and Parts List for the Rangeland Drill as the next publication.

3. No changes were recommended for the Range Seeding Handbook that was revised and issued in 1957.

Chemical Plant Control Committee

Acting Subcommittee Chairman - George Bradley, ACPS

There have been 7,000 copies of the Chemical Plant Control Handbook published. The assembly reported there is no need for reprint at this time. However, it was proposed the Committee review the publication to see that it is kept up to date with the latest information on chemical control of plants. Changes are to be made by the Committee in the form of amendments to the present handbook which will be distributed to the field.

Each agency is to submit to the Committee the information on proposed distribution of the amendments during the next year. Orval Winkler, Forest Service, proposed notice of amendments to be published in the American Society of Range Management Journal.

Cost Benefit Analysis Report

Subcommittee Chairman - Gerald J. Klomp

The form has not been revised or worked on during the past year. Its present form is to be considered all inclusive. It reflects dollar costs and details of project work such as transportation, water development, roads, etc. The cost benefit report has gone from a simple report to a complex reporting procedure.

Copies of the report form can be obtained from Mr. Klomp.

Report of Adequacy of the System for Stockpiling Parts for Specialized at the Forest Service Stockton Equipment Depot.

Subcommittee Chairman - Everett Doman, FS

The stockpiling of parts is proposed only for equipment for which parts are not available commercially that must be prefabricated. At the present this would only be for Rangeland Drills and Brushland Plow parts. Stocking would be based on supply needs for only a 3-year period.

The Committee reports parts procurement for the Brushland Plow has now started and will become operational by June 1961. Parts orders should not be by memo - but by the usual requisition procedure.

It was requested by Everett Doman that Joe Sonntag be made a member of the Subcommittee.

The following recommendations were submitted by the subcommittee for 1961.

1. The list for parts stocked at the Stockton Depot for the Brushland Plow together with a price list be made a part of the Equipment Service Manual and Parts list published for the Brushland Plow.
2. The same done for the Rangeland Drill when the project of publishing is being processed.
3. Full use be made of the Stockton facilities for parts procurement. Parts not stocked will be added as the demands develop. Parts needs are to be projected by the agencies to the Stockton Supply Depot at an early date.
4. All units not already having done so, furnish U. S. Forest Service, Region 5, San Francisco, California, the following information on equipment for which parts stockpiling will be provided.

Location of Equipment _____

Year Equipment was Manufactured _____

Planned Use _____

Plans for Additional Machines _____

Equipment Carrier Brochure

Subcommittee Chairman - W. F. Currier, FS

The Subcommittee was set up to evaluate and prepare a brochure on transportation equipment for hauling reseeding equipment. The brochure has been prepared with pictures and narrative and covers six types of equipment. This material has been distributed and is now a part of the Range Reseeding Equipment Handbook. (The plats for this material are in the files in Region 6).

The Subcommittee has fulfilled its assignment and has no further functioning responsibility.

Report on the Contour Trencher - TEB 702

Acting Subcommittee Chairman - Orval Winkler, FS

The work of this Committee has been very rewarding. At the present time there are approximately 50 operational units now in use by the Forest Service and the Bureau of Land Management. The unit developed is referred to as the Holt Trencher which has been developed in cooperation with the Holt Manufacturing Company.

The trencher under field operation successfully performs the following:

1. Builds contour trenches.
2. Ditcher - will throw the berm in either direction.
3. As a conventional plow on fireline construction.
4. To make a levee - throw both berms together.
5. As a contour "pitter" by raising and lowering on a rigid three-point hitch. New R-4 development.
6. Tree planting site preparation.

The trencher has limitations but development during the latter half of 1960 has made it possible to do trenching work on slopes with former limitations of 25% to 40% now. This has been made possible with the development of the "rigid 3-point hitch" and the Subcommittee reports it should be well perfected by next year. Also, by using a tractor D-7 with an angled blade to clear and partially level a strip along the upper side ahead of the trencher. Costs for doing trenching with the D-7 and trencher was approximately \$30.00 per acre.

A more recent development is being directed along the lines of bigger and heavier equipment. One unit has been developed in Region 4 consisting of an 8,000 pound unit with a 45" disc mounted on a TD-24 tractor. This has special promise for watershed work on steep slopes.

Slides were shown along with movies on the operation of the trenchers. Most all of the work done during 1960 was assigned to Murt Hiatt, Region 4, U. S. Forest Service, Ogden, Utah.

Model B Contour Furrower was used by the BLM in 1960 on various sites representative of rangeland conditions. The furrower was found to be satisfactory and the early failings were primarily confined to the auxiliary motor which have been remedied.

Ground Spraying Equipment Development Report - TEB 704

Subcommittee Chairman - A. B. Evanko, FS

Work has been carried on since 1958 to develop a suitable ground rig piece of equipment for control spraying of undesirable vegetation under wildland conditions.

This objective has been accomplished with the development of the "slip on spray unit" for crawler tractors. The equipment now ready for production has the following adaptations and capabilities.

1. Equipment can be adapted with only minor adjustment for any crawler tractor with
 - (a) Large tractor type units with 96-inch over-all tread width and cable front control. (D-7 and -8's and TD14 series) Only saddle adjustments are necessary. No change in spray unit.
 - (b) Small tractor mounted unit for tractors with 48-inch gage tread with maximum engine compartment width of 26 inches. (International TD-340, John Deere 430, and 440 models) Only saddle adjustments are necessary. No changes for spray units.
2. Has 300 gallon capacity tanks.
3. Has 24 foot spray boom with sectional unit control.
4. Has hand spray unit and attachment with retractable reel.
5. Has a vertical adjustable boom ranging from 30 inches to 56 inches high. This provides control in effective application for growth characteristics of the vegetation.
6. Optimum operational range on slopes 0-32%. Has performed up to 45% with the smaller units. Larger units have operated on slopes up to 55%.
7. Approximate cost will be \$1200.00 per unit. The cost for spraying with D-7 ranges from \$12.00 to \$15.00 per acre.
8. Brochure has been prepared showing prototypes, design and operational testing.

Recommendations

1. Consider the development phase completed. After more extensive use project reactivation may be timely to incorporate field operational changes that may be needed.

2. In 1961 complete specifications and drawings for each unit (large and small unit types) be completed and made available to agencies upon request.
3. The assembly approved the recommendation to include the specifications, drawings, etc., in the Range Seeding Equipment Handbook.

The Forest Service Arcadia Equipment Development Center presented slides taken during field testing operations.

Report on Development and Problems Concerning Aerial Spraying of Undesirable Plant Species.

Acting Subcommittee Chairman - V. N. Stokes, FS

With the constantly increasing demands to find new and better ways to control undesirable plant species on ranges and watershed lands the subcommittee was asked to report on developments and problems experienced by various agencies in the use of fixed wing and helicopter aircraft in spray operations.

The report of this committee is based on information submitted by the Forest Service. Information was submitted on spray operations from Regions 1, 2, 4 and 6, where acreages were sprayed as noted below:

<u>Region</u>	<u>Helicopter Acres</u>	<u>Fixed Wing Acres</u>
1	6,898	
2	1,734	25,600
4	-	11,750
6	<u>4,250</u>	<u> </u>
	12,882	37,350

The following tabulation provides some of the basic information collected by the subcommittee.

<u>Region</u>	<u>Type of Craft</u>	<u>Horse Power</u>	<u>Air Speed</u>	<u>Min. Ht. Flight</u>	<u>Capacity in Gallons</u>	<u>Width Swath</u>	<u>Elev.</u>
2	Snowplane	450	80	50'	-	80'	-
4	Gruman TBMS	-	150	50'	700	200'	-
1	G-2 Copter	-	45		20-30	42'	6500-8000'
6	12-E Hiller	-			70		3-5000'

Cost Analysis

1. Fixed Wing Craft Spraying

Cost data collected indicated a total cost of \$2.76 per acre for all costs in Region 2 using fixed wing craft. Contract cost for flying only in Region 2 - 84¢ per acre and in Region 4 - 70¢ per acre.

2. Helicopter Spraying

Wide variations in cost can be expected for spraying with helicopter from area to area depending on the elevation of the spray area and accessibility in supplying the heliport areas with chemicals and manpower.

The following tabulation shows the costs for copter spraying in Region 1, 2 and 6.

<u>Job Element</u>	<u>Region 1</u>	<u>Region 2</u>	<u>Region 6</u>
Herbicide	1.27	.39	-
Carrier	.41	.31	2.74*
Flying	1.16	1.07	-
Labor	1.78	.19	*.20
Motorized Equipment	.84	.10	.03
Miscellaneous	<u>.30</u>	<u>-</u>	<u>.015</u>
Total P/A cost	\$5.76	\$2.07	\$2.99

*Includes carrier, flying, diesel oil, and labor for mixing and application of spray.

The Region 1 areas were at elevations from 6500 - 8000 feet and the area was inaccessible which naturally would increase costs.

It is important to note the costs for helicopter spraying may be comparable to fixed wing operations. With helicopter a distinct advantage must be kept in mind whereby more effective control of spray application is required. This is especially important in preventing spray drift and damage to other multiple use interests, particularly with wildlife habitat and recreation and aesthetic values that may be temporarily or permanently damaged.

In all spray operations the recommended procedure for mixing the applications were followed with 2 pounds of 2-4d acid equivalent mixed in diesel oil and 3 gallons of spray mix applied per acre. The subcommittee report indicates sagebrush can be controlled with less acid and oil carrier when using a helicopter.

It is proposed in mixing to use 1½ pounds of 2-4d acid equivalent in diesel oil and spray mixture applied at 2 gallons per acre when using helicopter. No change is recommended for Wyethia control.

The importance of coordinating other multiple use interests cannot be over-emphasized in planning and executing spray projects. Particular consideration should be given to wildlife habitat, e.g., leave 5 chains next to streams to protect willow strip and spray to protect upland game bird habitat.

It is proposed that all planners and project supervisors become familiar with Edwards Air Force Base testing data compiled for the Hiller and G-3 helicopters. This data provides guides on safe load capacity at different elevations and air temperatures. The tests were made at sea level.

6,000 feet

11,000 feet

This information can be obtained from the Forest Service Division of Fire Control, Washington Office.

DISCUSSION LEADER - A. C. Hull, ARS

Report on Investigation of Seed Collection Equipment

Subcommittee Chairman - O. P. DeJulio, BLM

This subcommittee was appointed at the 1959 committee meeting at Tulsa, Oklahoma, when a need was expressed for development of suitable browse seed harvesting or collection equipment to provide a seed supply to meet new interest in habitat improvement through browse planting.

The subcommittee investigated four basic principles that have possibilities for adoption or modification to provide the type of equipment needed:

1. The vacuum principle.
2. The cutter head principle.
3. Shaker arm principle. (This type of collector would be required for browse with tree type growth form such as cliff rose.)
4. Reel and apron principle.

Plans for work on the prototype in FY 1961 will be devoted to design, fabrication and testing of suitable reel before proceeding with a power unit. This is scheduled for the latter part of FY 1961.

The committee plans to investigate a report of a commercially manufactured vacuum type seed collector located in California. The best features of this machine will be considered in this fiscal year planning in event the commercial machine does not fully meet our needs. Investigations made to date indicate that a satisfactory browse collector has not been developed commercially.

Slides were projected which showed the principles involved with the various types of seed collectors.

Report on Browse Seeding Equipment

Subcommittee Chairman - Richard L. Hubbard, FS

The subcommittee reported on the two designs of browse seeders presently being worked on and propose to combine the best features of both into one acceptable seeder. These seeders are referred to as (1) the Idaho adaptation of the Flexiplanter designed for planting in areas where competition from "cheatgrass" is a major factor in establishing browse seedlings, and (2) Hanson furrower-planter designed principally on land treatment areas where cabling has been done on pinon-juniper.

During 1960, a field meeting was held at Ephraim, Utah, where both pieces of equipment were demonstrated under field conditions. Attending were representatives from BLM, State Fish & Game Department, FS Intermountain Station, Tom Coldwell, Arcadia, and Mr. Hanson from Ephraim.

The Arcadia Equipment Development Center has now provided Mr. Hanson with design specifications for fabricating the prototype.

The subcommittee members recommended Mr. Perry Plummer assume primary subcommittee responsibility for the next year so he could work with Mr. Hanson in building the newly designed browse seeder.

Mr. Hanson, the builder of the original Hanson seeder, was asked to speak to the assembled committeemen. He praised very highly the cooperative relations he has had with the Utah State Fish & Game Department and the Forest Service Intermountain Station at Ephraim.

The subcommittee's major responsibility during the next year will be to followup on construction of the prototype by next year.

Report on Brush Control on Seeded Areas

Subcommittee Chairman - Chesley P. Seeley, BLM

The report of this subcommittee was presented by Chesley P. Seeley, BLM, Salt Lake City.

Control of brush on seeded areas can be manipulated by using combinations of the following:

1. Management
2. Chemical Treatment
3. Mechanical Means

The responsibility of the committee is primarily the investigation of mechanical means. Mr. Seeley asked for suggestions from the assembled membership on any experiences they have had that might give the committee some new phase of control to work on during next year.

1. Bill Currier reported on mowing rabbitbrush on seeded areas where reinvasion is taking place.
2. He also reported on the use of the brush beater on sagebrush with grass understory with some success. Other areas treated in like manner resulted in invasion of rabbitbrush.
3. Waldo Frandsen, SCS, suggested a combination spraying with mechanical treatment. The spray work to be done on areas outside treated areas to eliminate seed source that may contribute to reinvasion of treated sites.
4. Pat Murray, FS, reported some success by changes in class of stock after grasses have become over-mature, thus developing forced grazing on shrubs which keep them in balance. Sheep use of reseeded areas grazed by cattle was suggested.
5. Waldo Frandsen, SCS, reported studies at DuBois sheep station indicates fall grazing has been effective in controlling sagebrush. On the other hand, spring grazing resulted in increased sagebrush density.
6. Perry Plummer of Ephraim Station, reported the presence of some shrubs can be beneficial to the over-all vigor and health of the herbaceous vegetation. It provides better over-all composition which is beneficial in the wildlife habitat.

Mr. Seeley proposed the committee be discontinued in lieu of work being duplicated by other committees such as the root plow study and brush cutter. It was agreed to abandon the committee.

Evaluation of Root Plow

Subcommittee Chairman - Carl Fonte, SCS

Review of work done prior to 1960 on the Tonto National Forest on semi-desert shrubs, Prescott National Forest on chaparral type, Arizona, Uinta National Forest in Utah on gamble oak, Shoshone Indian Reservation on willow, sagebrush and wild rose type. Reports were also submitted on private land projects in northwestern Colorado on gamble oak, sagebrush, rabbitbrush, service berry, greasewood, and snowberry types.

Results varied on work done on a variety of soils, varying from light clay loam to heavy clay and rock-free loams to very shallow rocky soils. Results were noted as follows:

1. Kills varied from 20% to 90%.
2. Variation of kill was considered to be more attributable to machine operation than soil, except on extremely rocky soils where rocks prevented efficient operation.

3. Costs varied from \$5.00/acre on sage-rabbitbrush types to \$25.00 per acre on the oak brush type.
4. A major operational problem of the root plow is that the blade becomes dull making depth control difficult.
5. In most instances, oak resprouting continues to be a problem.
6. The Fleco Corporation reports successful results with the root plow on mesquite in Texas, Arizona and New Mexico. Kills of from 80% to 90% of the brush are obtained.
7. Fred Gavin, ARS, reported the root plow operation leaves a light fluffy seed bed which results in poor stands of herbaceous vegetation when seeding is done simultaneously or immediately after the operation.
8. Bill Cooperrider of the Prescott National Forest volunteered to work with the committee on a project on the Prescott National Forest in 1961.
9. Generally, the root plow is effective in controlling most all brush types except oak brush. More experimental work should be carried out in the Rocky Mountain area with the root plow on oak brush before drawing any definite conclusions.

A film was shown by Joseph Chiarella of BIA on root plow work done in the Arizona area.

Report on Brush Cutting and Brush Beating Equipment

Subcommittee Chairman - Howard Delano, BLM

Two separate field trials were conducted during the first part of FY 1961 using the trailer type heavy-duty brush cutter. The committee was also assigned responsibility to report on the "front-end" cutter but no work was done in this regard.

The following provides the basic information developed from the trials.

Trailer Type Brush Cutter

1. Wheel tractors have power limitations on this equipment that was designed for operation by small crawler tractors.
2. Equipping the cutter with rubber tires helped make operation with wheel tractor possible if the stubble height is not adjusted for less than 6".
3. Aprons need to be lowered to make equipment operative with the wheel tractor. With present design the aprons drag on the ground when brush is cut short. This dissipates trailer power.

4. The hydraulic system of the cutter needs changing to make both sides lower to the same height.
5. If it is desirable to cut brush closer to the ground, more power is required. Cutting on the tests was to a 6" "stubble height." Cutter will cut sagebrush up to 3" in diameter.
6. Safety goggles must be used at all times by personnel operating the equipment.
7. One distinct advantage of the brush cutter is that it leaves a good layer of organic material on the soil surface. It does not disturb or destroy the grass understory.
8. The brush cutter operation permits brush control and seeding operation at the same time. This helps materially to reduce costs.
9. It is recommended that further trials be conducted before definite conclusions are drawn on the general adequacy of the front end and trailer type.

Front End Mounted Brush Cutter Unit

This unit is now on the San Carlos Indian Reservation and it was proposed by A. B. Evanko that the unit be tested in the Southern California area on manzanita and chaparral type before abandonment or conversion to the trailing type. It was pointed out the front end type was primarily designed for testing in the control of Southern California vegetative type.

Mr. Silva of AEDC requested the unit be routed through the center at Arcadia for modification before going to a project area for testing as proposed by Evanko. It was agreed this should be done.

Films were shown of the field trials conducted by the BLM in the Ely, Nevada, area.

Report on Improvements Made to the Brushland Plow

Subcommittee Chairman - Howard Delano, BLM

Changes recommended at last year's meeting were made on the Brushland Plow by AEDC and field tests were conducted near Burns, Oregon, in October.

This included work on the 3-plow hitch and improvements in bearings with the development of sealed bearings.

1. It was determined by the field test at Burns that provision for turning with the 3-plow hitch were inadequate. Under most field operations, the 3-plow hitch is not adapted to work on small units. The 2-plow unit has been modified.

2. The new bearing now being manufactured for the Brushland Plow is a sealed bearing and will eliminate the troublesome aspects of the old bearing.
3. Tom Coldwell and others from the AEDC presented several slides on improvements made in the new sealed bearing and also the adaptations that can be made with the bearings to fit the two different sized shafts used on the plows.
4. Many of the details discussed are graphically presented in the new "Equipment Service Manual and Parts List for Brushland Plow" now ready for publication.
5. The AEDC has designed a hydraulic lift assembly and fabricated a pilot model which will be assigned to a field unit for testing at an early date.
6. Parts service for the Brushland Plow has been set up at the Forest Service Equipment Depot at Stockton, California. All future parts orders will be directed through the Regional Office, Region 5, San Francisco, California.

Report on Improvements Made to the Rangeland Drill

Subcommittee Chairman - A. B. (Tony) Evanko, FS

Continuing demands for, and use of the Rangeland Drill, prompted a need to make certain modifications to improve its efficiency and serviceability.

Accomplishments made during the past year are noted as follows:

1. A hinged tongue for the drill was designed and developed. New drills manufactured will be provided with the hinged tongue. This tongue assembly can be installed on older models of the drill.
2. Brochure was prepared in mid-year on the Rangeland Drill describing developments in the drill and pointing out the parts service provided by the Stockton Supply Depot.
3. Changes have been made in the beaver-tail ladder assembly since the field test of the prototype. The AEDC reports the changes meet operational needs.
4. The problem of drill tube malfunctioning has been resolved by increasing the thickness of the metal in the tubes.
5. New drills are equipped with acreage meters that are more accurate.
6. Hitch problems needing attention by AEDC are:
 - a. Develop stronger ball hitch with positive action.
 - b. Develop a workable adjustable hitch for drawbars of varying height.
 - c. Develop tandem hitch for dual operation of drills.

7. Slides were shown of a new "heavy duty" prototype which consisted essentially of armor planting the standard Rangeland Drill. This was for use on burned areas where stems of brush could cause damage to standard drill.

Slides were shown on changes made in the new hinged hitch and the modified beaver-tail for the Rangeland Drill by AEDC.

DISCUSSION LEADER - Joe Wagner, BIA

Report on Evaluation of the Oregon Press Seeder

Subcommittee Chairman - Howard Delano, BLM

This is a new project first being reported on at the 1960 meeting and the following progress and activity resulted from subcommittee work.

1. Mr. Dean Booster, Oregon State College, designed the original Oregon rangeland seeder. At field meeting last fall the subcommittee changed the name to Oregon Press Seeder to avoid confusion with the Rangeland Drill terminology.
2. Design drawings were submitted to AEDC early in 1960 for review and redrawings were made of sheets 2 and 3 of the plans drawn by Mr. Booster. The design drawings are very satisfactory for small shop production.
3. The machine weighs 5,000 pounds. The press wheels are 32" in diameter. The weight distribution is approximately 400 lbs. per press wheel with a total of 2 drill units.
4. Model IV prototype cost \$4000 and Mr. Booster indicated under production, with several orders, it would run about \$3500.
5. This unit is not intended to replace the Rangeland Drill, but was designed for special problem of seeding in light soils to provide a more firm seed bed.
6. A major improvement needed in the existing model is the drill tube location. With present prototype it is necessary for the operator to dismount from tractor, hang the tubes on the back rack, and then complete backing operations, then again stop and drop the tubes before proceeding. Mr. Sawyer of Squaw Butte reported this would be corrected before other machines were manufactured.
7. The equipment section of Region 4, Division of Engineering, will handle production and procurement of 10 seeders which have now been ordered.

A film was shown at the meeting of field operation and testing of this seeder.

A very outstanding job has been done in the development of this piece of equipment by Dean Booster, Art Sawyer, Don Hyder and Forrest Sneva of the Squaw Butte Station and the equipment development committee extends their compliments to these men.

Report on Development of Hitches for Range Seeding Equipment

Subcommittee Chairman - O. P. DeJulio, BLM

The subcommittee was assigned to work on development of three types of hitches during FY 1961.

1. Develop a three-plow hitch for Brushland Plow and hydraulic units for steering and lifting.
 - a. Other improvements are awaiting a more complete study of the 3-plow hitch and its effect on the steering of the plows. Studies so far indicate there is a definite problem when more than one plow is involved. It was evident in the 2-plow tandem and more so in the 3-plow combination. It is expected that tests of some of these findings can be made in the last quarter of FY 1961.
 - b. AEDC has designed hydraulic lift assemblies and has fabricated pilot models. They are still at Arcadia waiting field assignment and testing.
 - c. The BLM agreed to provide the testing site for the 3-plow hitch on Brushland Plows next field season in Oregon.
2. Designing of field testing hitch for Rangeland Drills: Progress was reported on this phase of equipment development. However, a commercial manufacturing company reported they have not considered the development of multi-unit hitches. It was pointed out by the manufacturers that certain performance advantages offered by single unit operation may be sacrificed with multi-unit operation.
3. Investigate possibilities of developing 3-point hitches for larger Holt units. This assignment was made to FS Intermountain Region under the direction of Murten G. Hiatt.
 - a. First it should be pointed out there were no commercial hitches of the 3-point type sturdy enough to meet the stresses and strains demanded in operation of Holt trenchers.
 - b. The committee working with Holt Manufacturing Company and International have built a rigid vertical lift 3-point hitch which is now being tested.
 - c. Ten vertical hitches will be operational by next field season and the final report will be ready the next meeting in 1962.

A short picture was shown by Caterpillar Tractor Company which showed the heavy duty tool bar and attachments they have developed.

Report on Investigation of the Portable Contour Trencher

Subcommittee Chairman - W. F. Currier, FS

The subcommittee reports the investigative work is complete with the development of the modified Merry Grader, a two-man operational portable trencher.

The unit is designed for use in trenching critical watershed areas in back country where it is impractical or impossible to use large equipment.

Changes and operational features are noted as follows:

1. A more powerful $9\frac{1}{2}$ h.p. Clinton motor has replaced the Briggs and Stratton used in the earlier investigation.
2. The cutting blade now used is a 20" "star contour type", two inches larger than blades used earlier.
3. The trencher is a two-man operational unit with cable controls enabling rear operator to direct the power unit in backward and forward directions.
4. Control rods enable the front operator to manipulate the dirt flaps as conditions on the terrain warrant for efficient operation.
5. Safety precautions that must be adhered to by the operators is wearing of goggles and respirators.
6. The trencher with the new modifications can build acceptable trenches 20" wide with 3 passes across each trench. (Earlier designs required 4-7 passes to construct a 12" trench).
7. The unit now available costs \$1500. Trenches can be built for .07¢ per linear foot.

The equipment is now operational and the subcommittee members have fulfilled their responsibility. It is recommended the subcommittee be discontinued.

Slides were shown of the portable trencher actually building trenches, and finished trenches on 60-70% slopes that had become stabilized by land treatment with the portable trencher.

Report on Development of Broadcast Seeder

Arcadia Equipment Development Center - E. E. Silva, FS

The subcommittee work to the present time is of an investigative nature seeking information from manufacturers on existing seeders on the commercial market. After completion of the survey, it is then proposed to study 2 or 3 of the best seeders to determine the features most suitable for developing an all purpose seeder for wild land seeding programs.

The exhaust seeder was considered, but was generally thought to have limitations. Dispersal of seed is too directional, and there is the need for another source of power to make a wider dispersal of the seed.

The subcommittee will continue to work on this project and the membership at large is requested to submit any valuable information they may have on seeders to the Arcadia Equipment Development Center.

Report on Unscheduled Servicewide Services

Arcadia Equipment Development Center - E. E. Silva, FS

Eugene Silva presented the financial statement of the range reseeding development work carried out at the Arcadia Equipment Development Center for FY 1961 as of 12/31/61. Work at the center has progressed very satisfactorily and consideration given to all projects as scheduled on priorities assigned. AEDC presented their discussions on equipment projects as they were presented by the subcommittee reports and these will not be repeated in this section of the report.

EIMCO Tractor Film

The Eimco Corporation, Salt Lake City, Utah

Eimco Tractor Company presented a film crawler tractor equipment with front end control units. Also, showed the equipment in operation on construction projects.

New Projects Recommended for Investigation and Design During FY 1962

Proposed a project to develop "mulcher equipment." This would also include methods of mulch preparation for establishing seedings.

New Projects or Project on which Further Work is Needed but No Funds Are Necessary at this Time.

Subcommittee appointed.

A Catchment Basin subcommittee proposed by McDuff and Wagner to study the various materials and means for providing water on open ranges and re-seeded areas.

A motion by Bob Nielson was passed recommending a subcommittee be assigned the responsibility of exploring and sifting ideas for new projects to be presented to the joint assembly at the annual meeting of the Equipment Development Committee.

ARCADIA EQUIPMENT DEVELOPMENT CENTER

RANGE RESEEDING PROGRAM FY 1961

Financial Statement as of Dec. 31, 1960

TEB No.	Project	Prior.	Forest Service		Bur. of Land Management		Bur. of Indian Affairs		Net
			Author.	Expend.	Balance	Author.	Expend.	Balance	
035	Rangeland Drill	2	1000	2008	-1008	500	492	8	-1000
328	Brushland Plow	3				3000	1116	1884	1884
501	Brush Cutter	1	2500	1385	1115	1000	872	128	1242
502	Browse Seeder	6	800	426	374				374
701	Develop Hitches	5	1000	250	750	1000	310	690	1440
702	Contour Furrower	8				3000	754	2246	2246
704	Spray Equipment	4	2500	3429	-929				-929
832	Unscheduled	-	3200	2069	1131				1131
901	Broadcast Seeder	7	2000	833	1167				1167
918	Laboratory Facilities	-	1100	845	255				255
1006	Port. Contour Trencher	9	400	100	300				300
1009	Eval. Ore. Press Drill	11				1500	1291	209	209
1010	Seed Collection Equip.	10	500	158	342	2000	509	1491	1833
TOTALS			15000	11503	3497	12000	5344	6656	10152
							1000	1001	-1

The committee will consist of membership from each agency as noted below:

<u>Agency</u>	<u>Representative</u>	<u>Address</u>
Bureau of Land Management	Winn G. Glover	Washington, D. C.
Forest Service	Anthony B. Evanko	San Francisco, Calif.
Colleges	Dean Booster	Oregon State College
Agric. Research Service	A. C. Hull	Logan, Utah
Soil Conservation Service	B. W. Allred	Washington, D. C.
State Fish & Game Dept.	Norman Hancock	Salt Lake City, Utah
Bureau of Indian Affairs	Graham Rice	Portland, Oregon

Mr. Winn Glover was elected chairman of this subcommittee.

Projects which were Completed or Recommended for Abandonment This Year

1. TEB - Portable Trencher
2. TEB - Equipment Carrier Brochure
3. TEB - Report on Brush Control of Seeded Areas.

Program for FY 1962

Discussion Leader - F. C. Curtiss, FS

Subcommittee preparation of work sheets for projects to be carried out during FY 1962 were presented and discussed. The proposed budget for FY 1962 was also presented and approved.

Project subcommittee work proposed for FY 1962:

1. Brush Cutter - The front end brush cutter study work is to be revitalized, checked by AEDC, and field tested in shrub type in Southern California. Also, proposed improvements made on the trailing brush cutter.
2. Rangeland Drill - Study the "beaver-tail" further. This would be carry-over work. No changes are recommended in the basic design of the Rangeland Drill.
3. Hitches - Continue with the work now started on the 3-point and the multi-plow or equipment hitches.
4. Browse Seeder - Perry Plummer, FS, will direct the project work in building the prototype designed by AEDC. The unit will be built by Mr. Hanson of Ephraim, Utah.
5. Spray Equipment - Work to be done here will be performance testing under field conditions. Work to be done will also be the preparation of the report which will be included in the range equipment handbook for field distribution.

6. Brushland Plow - Work to be continued on the project will be primarily that of field testing and completing the "Equipment Service Manual and Parts List for Brushland Plow."
7. Oregon Press Seeder - This unit is presently scheduled for manufacturing. AEDC will continue to study the project with Region 4 Forest Service personnel. Some changes have been recommended and the work will continue.
8. Broadcast Seeder - AEDC will continue to investigate equipment now on the market commercially. Combine the best features of 2 or 3 into an acceptable broadcaster.
9. Mulcher Equipment - Investigate existing equipment on the market and recommend the most suitable equipment or propose design of prototype.
10. Browse Seed Collector - Committee continue with investigation and study of a suitable seed collector using the best features of equipment to design prototype.
11. Contour Trencher - Finalize the work of testing and reporting. Pursue the development of the Model B unit.
12. Unscheduled Series - Attend meetings. Prepare drill publication "Equipment Service Manual and Parts List for Rangeland Drill."

<u>Priority</u>	<u>Project</u>	<u>\$-FY 1962</u>
1	Brush Cutter - Trailing Front End	\$1400.00 <u>2000.00</u> \$3500.00
2	Rangeland Drill - Beaver Tail Testing and publication	\$ 300.00 <u>1700.00</u> \$2000.00
6	Brushland Plow	\$1000.00
5	Spray Equipment - Test and spray on going project Specification & report preparation	\$ 200.00 <u>1000.00</u> \$1200.00
3	Hitches (Continuing Project) 3-point and multi- towing hitch	\$1200.00
4	Browse Seeder (R-4)	\$1800.00
8	Broadcast Seeder - Phase 1-3 completed Phase 4 now needed	\$2000.00
11	Contour-Trencher-Furrower (Finalize contour trencher Model B) (R-4)	\$1200.00
10	Browse Seed Collector	\$2500.00
7	Oregon Press Seeder	\$2000.00
12	Unscheduled (Attending Meetings) Rangeland Drill - Publication Handbook (Revisions for name service manual)	\$1000.00 <u>1200.00</u> \$2200.00
9	Mulcher Equipment	<u>\$1500.00</u>
		\$22,100.00

Miscellaneous

At future meetings provide more identification "cards" for membership identity at the meeting.

Followup on finance arrangements from Washington office agency heads for proposed FY 1962 budget.

Meeting adjourned 5:00 P.M.

Program for the 1961 Meeting
Range Seeding Equipment Committee

Fifteenth Annual Meeting
January 29 and 30, 1961

Newhouse Hotel
Salt Lake City, Utah

GENERAL CHAIRMAN
F. C. Curtiss - FS

January 29

Discussion Leader - Robert D. Neilson, BLM

- 9:00 A.M. - Report on Operating Hints revision and Service Manuals with Parts List. A. C. Hull, Chairman of Subcommittee, ARS.
- 9:30 A.M. - Chemical Plant Control Committee Report. Donald R. Cornelius, Chairman of Subcommittee, ARS.
- 10:00 A.M. - Cost-benefit Analysis Report. Gerald J. Klomp, Chairman of Subcommittee, ARS.
- 10:30 A.M. - Report on adequacy of system for stockpiling parts for specialized equipment at FS Stockton Equipment Depot. Everett Doman, Chairman of Subcommittee, FS.
- 10:45 A.M. - Equipment Carrier Brochure. W. F. Currier, Chairman of Subcommittee, FS.
- 11:00 A.M. - Report on Contour Trencher. Bill Cooperrider, Chairman of Subcommittee, FS.
- 11:30 A.M. - Ground Spraying Equipment Development Report. A. B. Evanko, Chairman of Subcommittee, FS.

Discussion Leader - A. C. Hull, ARS

- 1:00 P.M. - (1) Report on Development and Problems concerning Aerial Spraying of Undesirable Plant Species. Elwin W. Stevens, Chairman of Subcommittee, FS.
- (2) Improvements to Spray Application Techniques. Elwin W. Stevens, Chairman of Subcommittee, FS.
- 1:30 P.M. - Report on Investigations of Seed Collection Equipment. O. P. DeJulio, Chairman of Subcommittee, BLM.

January 29 (Continued)

- 2:00 P.M. - Browse Seeding Equipment Report. Richard L. Hubbard, Chairman of Subcommittee, FS.
- 2:30 P.M. - Report on Brush Control on Seeded Areas. Chesley P. Seeley, Chairman of Subcommittee, BLM.
- 3:00 P.M. - Evaluation Report of Root Plows. Elwin W. Stevens, Chairman of Subcommittee, FS.
- 3:30 P.M. - Report on Brush Cutting and Brush Beating Equipment. O. P. DeJulio, Chairman of Subcommittee, BLM.
- 4:00 P.M. - Report on Improvements made to the Brushland Plow. Howard Delano, Chairman of Subcommittee, BLM.
- 4:30 P.M. - Report on Improvements made to the Rangeland Drill. A. B. Evanko, Chairman of Subcommittee, FS.

January 30

Discussion Leader - Joe Wagner, BIA

- 8:00 A.M. - Report on Evaluation of Oregon Press Seeder. Howard Delano, Chairman of Subcommittee, BLM.
- 8:30 A.M. - Report on Development of Hitches for Range Seeding Equipment. O. P. DeJulio, Chairman of Subcommittee, BLM.
- 9:00 A.M. - Report on Investigation of Portable Contour Trencher. W. F. Currier, Chairman of Subcommittee, FS.
- 9:15 A.M. - Report on Development of Broadcast Seeder. E. E. Silva, Chairman of Subcommittee, FS.
- 9:30 A.M. - Report on Unscheduled Servicewide Services. E. E. Silva, Arcadia Equipment Development Center, FS.
- 9:45 A.M. - Eimco Tractor Film.
The Eimco Corporation, Salt Lake City, Utah.
- 10:30 A.M.-12:00 Noon - Formulation of tentative program for 1962.
1. Receive new project proposals.
 2. Organize subcommittees and make CY 1961 assignments.

January 30 (Continued)

Discussion Leader - F. C. Curtiss, FS

1:00-3:00 P.M. - Subcommittees will draft project writeups for
FY 1961.

3:00-5:00 P.M. - Group consideration of project writeups. Assign
priorities.

5:00 P.M. - Adjournment

Where pertinent, each of the above subject time allowances will include
a report by Eugene Silva, or his appointed representative, of the work
being carried on at the Arcadia Equipment Development Center for FY 1961.

Register of Attendance

U. S. DEPARTMENT OF AGRICULTURE

Agricultural Research Service

Forrest Sneva	Burns, Oregon
Russell J. Lorenz	Mandan, North Dakota
A. T. Bleak	Ephraim, Utah
C. H. Herbel	Las Cruces, New Mexico
C. M. McKell	University of California, Davis, Calif.
W. J. McGinnies	CSU, Fort Collins, Colorado
Forrest M. Willhite	Box 786, Grand Junction, Colorado
Fred Lavin	Crops Research, P.O. Box 858, Mesa, Ariz.
Fred B. Gomm	Range Management Dept., MSC, Bozeman, Mont.
Jerry Klomp	Box 778, LaGrande, Oregon
Dillard H. Gates	Dept. of Forest & Range Management, WSU, Pullman, Washington
George A. Rogler	U. S. Field Station, Mandan, North Dakota
E. H. McIlvain	Woodward, Oklahoma
Wesley Keller	Beltsville, Maryland
R. E. Bement	Fort Collins, Colorado
C. B. Rumburg	Burns, Oregon
W. A. Sawyer	Burns, Oregon
R. A. Evans	Reno, Nevada
Dayton L. Klingman	Plant Industry Station, Beltsville, Md.
A. C. Hull, Jr.	USU, Logan, Utah
Lynn O. Hylton	Room 272 South Hall, CSU, Fort Collins, Colo.
M. C. Shoop	Woodward, Oklahoma
William W. Wagner	CRD Box 245, Berkeley 1, California

Agricultural Conservation Program Service

George E. Bradley	Washington, D. C.
-------------------	-------------------

Agricultural Extension Service

Karl G. Parker	Extension Service, MSC, Bozeman, Montana
Dixie R. Smith	University of Wyoming, Laramie, Wyoming.
Melvin S. Morris	University of Montana, Missoula, Montana

U. S. Forest Service

A. B. Evanko	San Francisco, California
R. M. Housley	Flagstaff, Arizona
James P. Blaisdell	Washington 25, D. C.
H. A. Mullin	Albuquerque, New Mexico
Lowell K. Halls	2026 St. Charles Ave., New Orleans, La.
J. H. Sonntag	San Francisco, California
Wally Dresskell	Missoula, Montana
Avon Denham	Portland, Oregon

U. S. Forest Service (Continued)

Orval E. Winkler	Ogden, Utah
Everett R. Doman	San Francisco, California
David M. Gaufin	Washington 25, D. C.
Murten G. Hiett	Ogden, Utah
Richard W. Smith	Ogden, Utah
Ray P. Connelly	Ogden, Utah
Marvin Seddon	520 So. Redwood Rd., Salt Lake City, Utah
Thomas Coldwell	Arcadia Equip. Dev. Center, Arcadia, Calif.
Charles W. Howe	Arcadia, California
R. M. DeNio	Washington 25, D. C.
E. E. Silva	Arcadia, California
M. L. DeSpain	St. Anthony, Idaho
I. Pat Murray	Albuquerque, New Mexico
Paul Hansen	Ephraim, Utah
Elbert H. Reid	Fort Collins, Colorado
W. F. (Bill) Currier	Portland, Oregon
James L. Jacobs	Ogden, Utah
W. O. Shepherd	Ogden, Utah
B. K. Cooperrider	Prescott N.F., Prescott, Arizona
Grant G. Williams	Richfield, Utah
C. E. McDuff	Albuquerque, New Mexico
L. K. Clark	Ogden, Utah
Richard L. Hubbard	Nevada Street, Susanville, California
Mal Holt	Boise National Forest, Boise, Idaho
Wayne W. West	Atlanta, Georgia
Dwight W. Kimsey	1354 E. 2nd, Reno, Nevada
Ted E. Cox	853 E. 7th South, Salt Lake City, Utah
V. N. Stokes	Missoula, Montana
A. Perry Plummer	Ephraim, Utah
Frank C. Curtiss	Washington 25, D. C.
Hallie L. Cox	Logan, Utah

Soil Conservation Service

John L. Schwendiman	Pullman, Washington
Al E. Young	Spokane, Washington
Claude Dillon	Ephrata, Washington
F. G. Renner	Washington, D. C.
Harold L. Harris	Aberdeen, Idaho
M. D. Atkins	134 So. 12th St., Lincoln, Nebraska
A. L. Hafenrichter	Portland, Oregon
Arnold Heerwagen	Bldg. 50, Denver Federal Center, Denver, Colo.
J. Ross McLaughlin	Court House, Pueblo, Colorado
Carl S. Fonte	Box 4126, Colorado Springs, Colorado
Ben Heywood	Logan, Utah
Waldo R. Frandsen	222 So. West Temple, Salt Lake City, Utah
Donald Fulton	Roosevelt, Utah
Don S. Douglas	434 Plankinton, Milwaukee, Wisconsin
Blain Halliday	1479 Wells Ave., Reno, Nevada
Joseph J. Alessi	Box 47, Trinidad, Colorado

U. S. DEPARTMENT OF THE INTERIOR

Bureau of Indian Affairs

Joseph B. Chiarella
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Cyril L. Jensen
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Myrvin E. Noble
Chesley P. Seely
Edmond R. Bates
Maurice W. March
Roy W. Bean
Leroy C. Sweet
William Campbell
H. W. Pearson
Jim Youkam
E. J. Peterson
A. W. Zimmerman
Howard R. Delano
Glen H. Lipscomb
W. G. (Win) Glover
Leon R. Nadeau
O. P. DeJulio
Grant P. Rogers
George D. Leah
Claire E. Letson
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Bureau of Reclamation

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E. D. Bollick

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Ephrata, Washington

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Don Hervey

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Utah Fish & Game Department

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Lubbock, Texas

Utah State University

John F. Vallentine

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Corvallis, Oregon

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Roy C. Dawson

FAO - NARO - Washington 25, D. C.

Miscellaneous Equipment Company Representatives

William E. Deedley
Dean M. Morgan

John Deere Equipment Company, Portland, Ore.
Caterpillar Tractor Co., 25550 Calaioga,
Hayward, California

Jim Thurmond
Joe Frankenberg

Idaho Tractor Co., Meridian, Idaho
Fleco Co., P. O. Box 2370, Jacksonville,
Florida

J. L. Diamond
Allen Fulton
J. D. Walhof
Walt Hansen

Caterpillar Tractor Co., Peoria, Illinois
John Deere Co., Portland, Oregon
Cesco - 1410 North Orchard, Boise, Idaho
Ephraim, Utah

Ranchers

I. P. Beckett

715 School Street, Craig, Colorado

Miscellaneous

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Reedpoint, Montana

E. W. Anderson

Box 798, Pendelton, Oregon

Naphtali Tadmor

Dept. of Agronomy, Agricultural Research
Station, Belt Dagan, Israel

SUBCOMMITTEE ASSIGNMENTS FOR FY 1962

Operating Hints and Service Manual Handbooks

A. C. Hull, Chairman	ARS	Logan, Utah
Joe Wagner	BIA	Washington, D. C.
John R. Killough	BLM	Washington, D. C.
Harold Cooper	SCS	Bozeman, Montana
Eugene Silva	FS	Arcadia, California
Henry Mullin	FS	Albuquerque, New Mexico

Subcommittee on Chemical Plant Control

Karl G. Parker, Chairman	FES	Bozeman, Montana
Donald R. Cornelius	ARS	Berkeley, California
Don Hyder	ARS	Burns, Oregon
Fred H. Tscherley	ARS	Tucson, Arizona
Claire Latson	BLM	Washington, D. C.
W. C. Robocker	ARS	Reno, Nevada
Lowell K. Halls	FS	Tifton, Georgia
Hurlon Ray	SCS	Fayetteville, Arkansas
John L. Rogers	FS	Prineville, Oregon

Subcommittee on Cost-Benefit Analysis

Gerald J. Klomp, Chairman	ARS	La Grande, Oregon
C. V. Plath	Oregon St. Col.	Corvallis, Oregon
Joe Wagner	BIA	Washington, D. C.
John R. Killough	BLM	Washington, D. C.
Russell Loyd	U. of Nev.	Reno, Nevada
Lynn Rader	FS	Susanville, California

Subcommittee for Contour Trencher and Furrowers

Orval E. Winkler, Chairman	FS	Ogden, Utah
Wilbur Currier	FS	Portland, Oregon
Burt Silcock	BLM	Boise, Idaho
LaMar Mason	SCS	Murray, Utah

Browse Seeding Equipment Subcommittee

Perry Plummer, Chairman	FS	Ephraim, Utah
Richard L. Hubbard	FS	Susanville, California
Robert Boone	F&WL Serv.	Portland, Oregon
Anthony Evanko	FS	San Francisco, California
Hugh A. Harper	Idaho F&G Dept.	Boise, Idaho
Cyril L. Jensen	BLM	Denver, Colorado
Wilbur Currier	FS	Portland, Oregon
Walter McGregor	Cal. F&G Dept.	Sacramento, California

Browse Seeding Equipment Subcommittee (Cont'd)

Lawrence Riordan	Colo. F&G Dept.	Denver, Colorado
Norman Hancock	Utah F&G Dept.	Salt Lake City, Utah

Brush Cutting and Brush Beating Equipment

O. P. DeJulio, Chairman	BLM	Salt Lake City, Utah
A. B. Evanko	FS	San Francisco, California
George T. Nordstrom	BIA	Sacramento, California

Subcommittee on Improvement of the Brushland Plow

James S. Andrews, Chairman	BLM	Denver, Colorado
Henry A. Mullin	FS	Albuquerque, New Mexico

Subcommittee on Spray Equipment

A. B. Evanko, Chairman	FS	San Francisco, California
C. A. Graham	FS	O'Neals, California
J. R. Bentley	FS	Berkeley, California
W. F. Currier	FS	Portland, Oregon
George T. Nordstrom	BIA	Sacramento, California
Fred Davis	BLM	Sacramento, California

Subcommittee on Aerial Spraying

Elwin W. Stevens, Chairman	FS	Denver, Colorado
Victor Stokes	FS	Missoula, Montana
Orval E. Winkler	FS	Ogden, Utah
George Turcott	BLM	Billings, Montana
Cyril L. Jensen	BLM	Denver, Colorado

Subcommittee on the Development of Hitches

Orval E. Winkler, Chairman	FS	Ogden, Utah
Don Hunter	BLM	Salt Lake City, Utah
Henry Mullin	FS	Albuquerque, New Mexico

Subcommittee on Browse Seed Collector

Max Bridge, Chairman	BLM	Reno, Nevada
Charles W. Howard	FS	Arcadia, California
Ralph R. Hill	FS	Washington, D. C.

Subcommittee on Rangeland Drill Improvement

A. B. Evanko, Chairman	FS	San Francisco, California
W. F. Currier	FS	Portland, Oregon
Lee Nadeau	BLM	Portland, Oregon

Subcommittee to Evaluate Root Plows

Carl Fonte, Chairman	SCS	Colorado Springs, Colorado
Elwin W. Stevens	FS	Denver, Colorado
Ed Bates	BLM	Cheyenne, Wyoming
Wm. McGinnies	ARS	Fort Collins, Colorado
Joseph Chiarella	BIA	Phoenix, Arizona
Irvin Pat Murray	FS	Albuquerque, New Mexico

Subcommittee to Acquire Parts for Equipment

Everett Doman, Chairman	FS	San Francisco, California
Joseph H. Sonntag	FS	San Francisco, California

Subcommittee to Develop Broadcast Seeder

E. E. Silva, Chairman	FS	Arcadia, California
Richard Hubbard	FS	Susanville, California
Norman Hancock	Utah F&G Dept.	Salt Lake City, Utah
A. B. Evanko	FS	San Francisco, California
W. F. Currier	FS	Portland, Oregon
Duane Jensen	BLM	Salt Lake City, Utah

Subcommittee to Evaluate Oregon Press Seeder

Howard DeLano, Chairman	BLM	Portland, Oregon
Don Hyder	ARS	Corvallis, Oregon
W. F. Currier	FS	Portland, Oregon
Dean Booster	Ore. St. Col.	Corvallis, Oregon

Catchment Basin Subcommittee

Clifford E. McDuff, Chairman	FS	Albuquerque, New Mexico
Glen Lipscomb	BLM	Phoenix, Arizona
Joseph B. Chiarella	BIA	Phoenix, Arizona
C. W. Lauritzen	ARS	Utah St. Univ., Logan, Utah

Subcommittee on Evaluation of Mulching Machines

Harry W. Pearson, Chairman	BLM	Santa Fe, New Mexico
Bill Cooperrider	FS	Prescott, Arizona; Stewart, Nevada
Anthony G. Wielang	BIA	P.O. Box 11, Stewart, Nevada

Exploratory Subcommittee

W. G. Glover, Chairman	BLM	Washington, D. C.
Anthony Evanko	FS	San Francisco, California
Graham Rice	BIA	Portland, Oregon
Dean Booster	Ore. St. Col.	Corvallis, Oregon
A. C. Hull	ARS	Logan, Utah
B. W. Allred	SCS	Washington, D. C.
Norman Hancock	State F&G Dept.	Salt Lake City, Utah